Design and Implementation of Heterogeneous Workflow System Integration Mode Based on SOA Framework

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Abstract. With the improvement of enterprise information level, Information system gradually replaced the original manual office. However, due to the early construction does not have the global view, leading enterprises inside the sets of heterogeneous autonomous business systems. This paper presents a workflow architecture based on SOA integration, to a certain extent, to solve the problem of heterogeneous workflow to meet the flexible and seamless workflow requirements of the enterprise.

Introduction

Research Status

Information systems as an important factor assimilate into the daily office. The original paper office and manual statistics gradually replaced by the system. However, the different stages of the system construction, architectural design differences, the development of language inconsistencies between the various systems lead to information silos. With the increasingly close cooperation among various departments within an enterprise and the continuous establishment of cooperation among enterprises, the characteristics of heterogeneity, autonomy and distribution of business systems have brought varying degrees of limitations in internal information synchronization.

In view of the above problems, the traditional solution is dedicated interconnection. This method requires a lot of workload and increases the system risk, which cannot meet the needs of multi-system polymerization of enterprises. The failure of a single system leads to the global business information handling is not timely. Many researchers have proposed corresponding solutions to this problem. For example, Zhiquiang Li, Miao Fang used reliable data transmission and heterogeneous databases to solve the problem.[2]

This paper introduces a heterogeneous workflow integration scheme based on Service-Oriented Architecture (SOA), which creates conditions for decoupling of heterogeneous workflows.

SOA Architecture and Workflow Introduction

As a component model, SOA connects services provided by different programs through services and protocols.[1] SOA takes the concept of service as the central idea, and each service is an independent application or a series of functions provided by the service oriented application system. Services can be understood as providers of services to complete a series of operations and provide expected conclusions for the users of the service. This operation and results may affect the state of service users, and at the same time, service providers may also respond to changes.

Under the SOA framework, business logic on the form or component services can be shared, reused and configured for service users, service realization is the black box. In order to solve the new business needs of enterprises, enterprises can increase services or update existing services in a modular manner, so as to ensure that the existing enterprise information resources can still be used, rather than overthrow the reconstruction.
**Definition and Basic Characteristics of SOA Architecture**

In SOA architecture, the communication between services can be summarized through the streamlined, accurate definition of interfaces and protocols, without considering the underlying programming interface and communication model SOA, which can be summarized as the following basic features:

1. **Role and relationship definition**, SOA architecture is based on three roles to achieve, service intermediaries, service requesters, service providers, the three collaborative cooperation. Roles and relations as shown in Figure 1:

   ![Figure 1. SOA architecture diagram.](image)

2. **Basic elements**, the SOA architecture has the following three basic elements:
   1. WSDL, which is used to describe services
   2. UDDI, which is used to register and find services
   3. SOAP, which is used to communicate messages between service requesters and service providers

**Introduction and Definition of Workflow**

Workflow in order to achieve a desired goal, using the automated method among multiple participants automatically transfer documents, according to the predetermined logic rules and protocol interaction information. Workflow Management Alliance defines workflow as a kind of business process that can be fully executed automatically. According to a series of process rules, the document, information or task is transferred and executed among different executors. It has the following two basic characteristics:

1. **Workflow basic elements**
   1. Node: Workflow is the simulation of the actual workflow, and the workflow nodes correspond to an activity or operation in the actual work.
   2. Route: For the trigger node, after the current node is completed, the route points to the next node.

2. **Workflow Engine**

   The engine is a series of trigger rules, it is used to control the workflow orderly flow, the current node is completed, according to the routing path, automatically trigger the execution of the next node, and the exception process in the process of execution, set the corresponding processing method.

**Design and Modeling of Heterogeneous Workflow Integration Based on SOA Architecture**

At present, there are many inside and outside the enterprise autonomy, distribution system. Due to legacy reasons, these systems usually do not have a standardized interface between each other. Faced with complex services that require multiple system collaboration, the traditional integration approach is difficult to meet the needs of dynamic variability and easy implementation.

Based on the basic idea of SOA, in order to solve the new business requirements by using the existing system and infrastructure, the integrated development framework is presented as Figure 2:
Figure 2. Heterogeneous workflow integration model diagram based on SOA architecture.

1) Presentation Layer: Display the global workflow effect of multi system integration through the client to the user.

2) Application Layer: Based on the actual needs, through the unified platform to find and invoke the services, to achieve the re-integration of the workflow in the distributed system.

3) Service Layer: Service providers and service requesters participate in the activities, the service provider provides services to the outside, and the service requesters invoke services through interfaces and protocols. Service registration center is a unified publishing service organization.

4) Component Layer: A component represents a physical fragment of the system blocks, which encapsulates part of the functionality of the application layer system into services and provides access to the encapsulated service through its interface. By using transparent RPC remote service invocation scheme, you can adjust remote services like invoking local services. The network communication framework provides the functions of remote communication and information exchange between heterogeneous distributed systems, and ensures efficient and stable message transmission on the basis of ensuring that both parties understand the semantics of the protocol. Service directory framework, based on the service layer registry directory service, transforms the application system function into the service interface.

5) System Layer: each relatively independent subsystem in the enterprise, these systems do not have a unified interface between each other, can be invoked each other, become "isolated island".

Implementation of Heterogeneous Workflow Integration Model Based on SOA Architecture

Instantiation of Heterogeneous Workflow Integration Model Based on SOA Architecture

The integrated workflow system based on the above SOA architecture is based on the traditional workflow system and combines the basic features of service-oriented. RPC is a remote call protocol for this instance. As a wrapper based on RPC encapsulation protocol, Dubbo encapsulates a single workflow model in the actual business system as a service. The RPC service is unified registered in the service center, and the RPC service encapsulated by the business system can be called by other systems, and the service system is regarded as the provider of the service. All workflow engines in the integrated system need to be able to interpret the same process model and share the same set of workflow control data. Workflow integration system based on SOA architecture can be described as Figure 3.
Figure 3. An example of heterogeneous workflow integration based on SOA architecture.

**Key Point Explanation**

The global workflow platform has an independent global workflow engine, and the user can quickly and conveniently establish the global workflow through the process definition tool. According to the user defined process, the engine sends the messages to the service registration center through the RPC service invoke interface during the execution process, and analyzes the response result returned.

The registry is implemented on Zookeeper. The Zookeeper based service registration and discovery framework consists of three roles: service provider, service registry, and service requestor.

1. **Service provider**: It provides basic information to the service center, including the system, the IP and port of the service, and the request URL.
2. **Service center**: It is responsible for storing the basic information of the service, and through the zookeeper watcher mechanism to achieve push new information to service requestor, to ensure that the service is really available.
3. **Service requestor**: It invokes the service through the service center, and does not depend on the services provided by the third parties throughout the process.

RPC service wrapper is mainly used to encapsulate the function of distributed workflow system by RPC service. Through the encapsulation of system function as RPC service, the cross platform can be realized and the communication between applications can be realized. Dubbo provides transparent remote method invocation with simple configuration, no API intrusion, and supports Hessian, HTTP, RMI and many other protocols. Service providers and service requesters don't need to know the specific implementation details of the service, just know the method of published and invoked.

**Summary**

This paper provides an idea and solution for heterogeneous workflow collaboration. Based on the SOA architecture, heterogeneous platforms of different platforms are logically integrated on a platform by encapsulating services and invoking them. To some extent, seamless connection is realized. However, the cross relation between workflows has not been considered in this paper, which is one of the directions for future research. It is also found that good communication approaches can greatly improve service request efficiency and reduce request time\(^{[5,6]}\), which is also one of the future research directions.
References


